

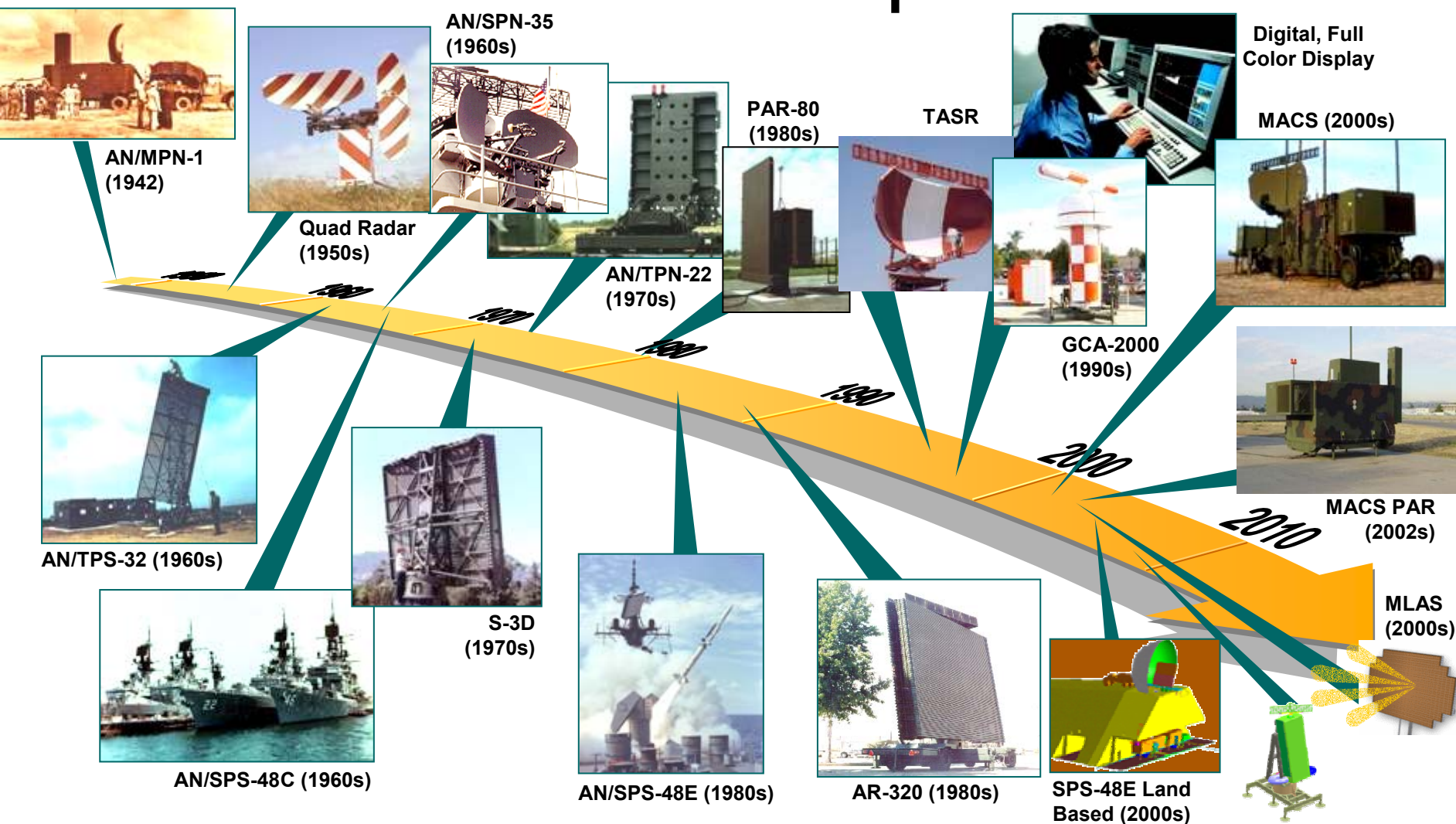
Implementation of New Technologies in Radar Systems

Michael Coluzzi, Larry Carlin, Makoto
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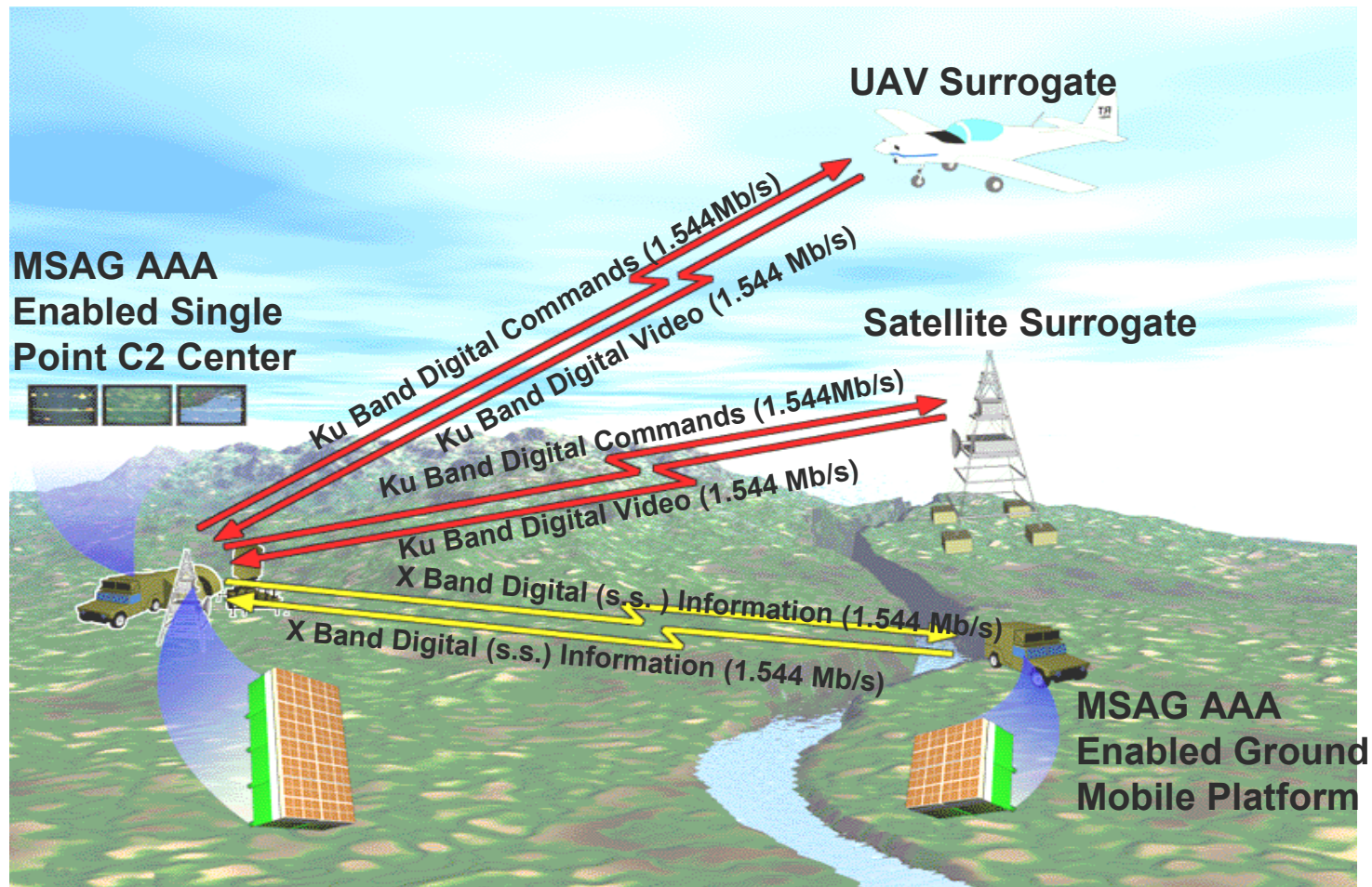
Outline

- Background
- Development of active antennas
- Implementation of digital receiver in Radar system with ASIC
- Prototype of Radar system on FPGA
- Future Plans

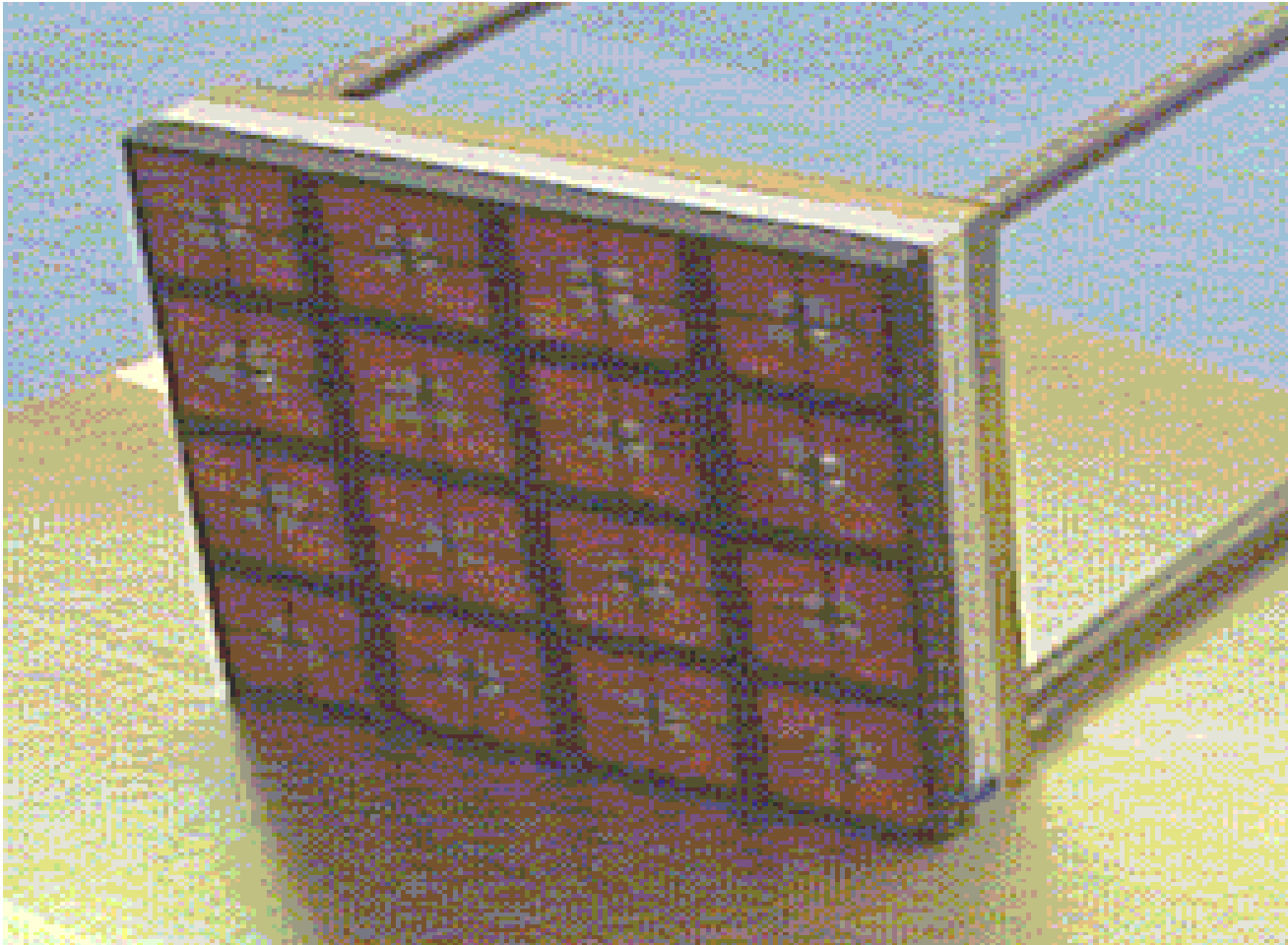
Radar development



Development of active antennas



Active element development



Four-Square Patch Radiator

Multiple beam/Multiple Function Antenna

- Because multiple beam antenna arrays have been developed, multiple functionalities are possible
 - Radar
 - Communication
 - SAR

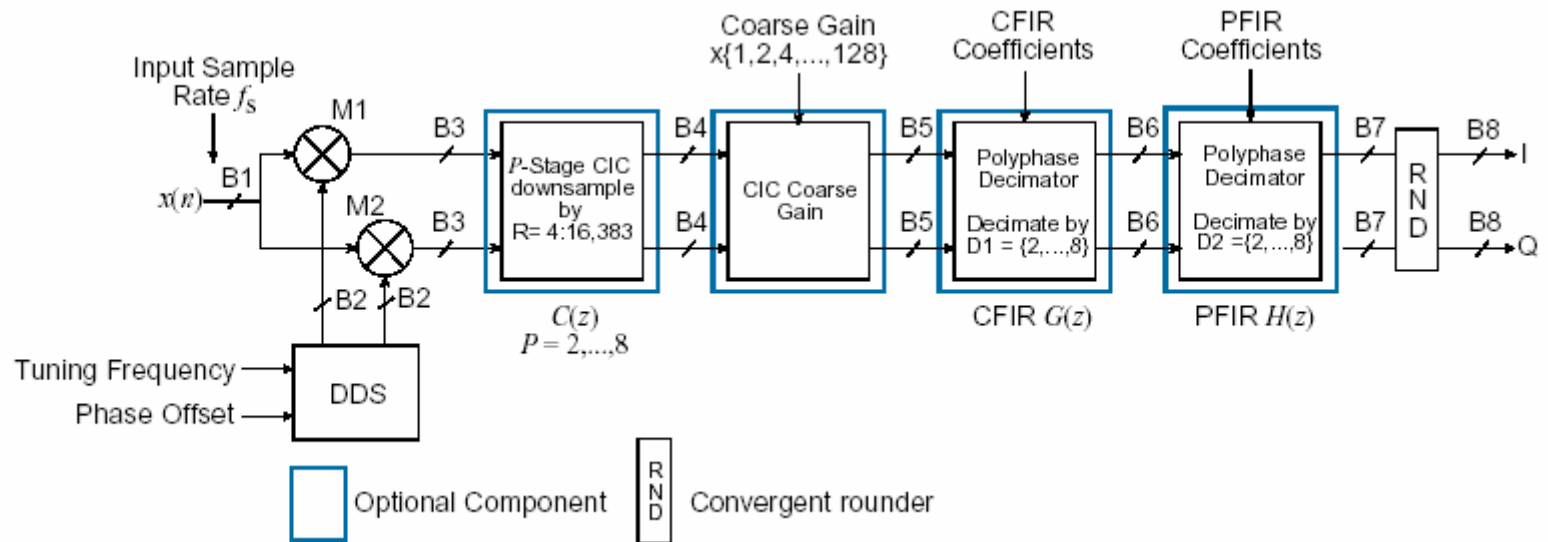
Cost drivers

- To transfer technology from defense domain to consumer domain, one must concentrate on price
- To develop new cost effective products, one must look to industries that have formidable investment and utilize their developments
 - Cell phone
 - Micro-processor
 - FPGA

Digital receiver ASIC designed for cellular basestations implemented in a radar system

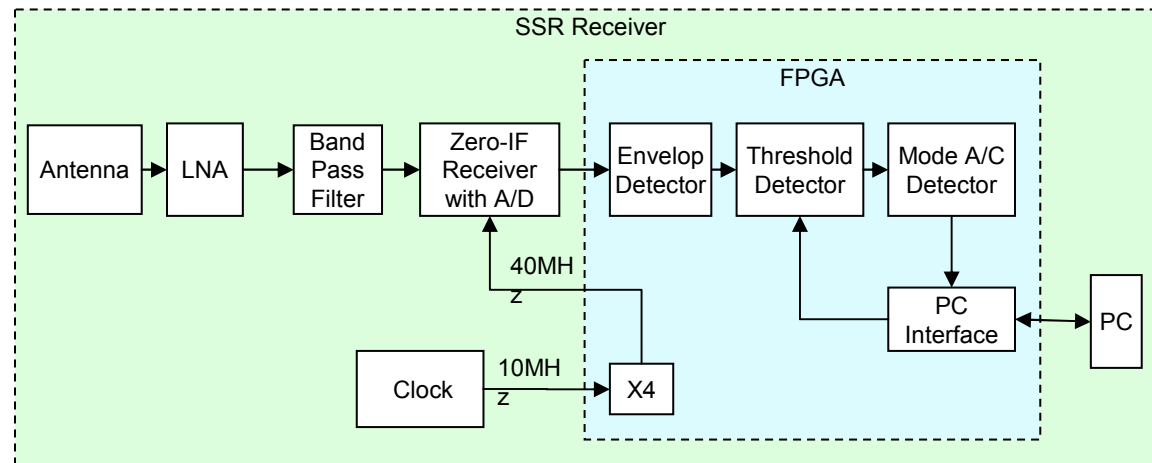
- ITT Gilfillan latest radars have cellular based digital receivers
- Decomposition of I and Q
- Decimate by 4 to 4k filter
- CIC (Cascade Integrate Comb)
- CFIR (Compensating Finite Impulse Response Filter) to eliminate $\sin x/x$ pass-band of CIC
- PFIR (Programmable Finite Impulse Response Filter) to provides the narrow filtering between the passband and the stopband.

Block diagram of common digital filtering



From Xilinx Digital Downconverter IP Core

Implementation of radar receiver with zero-if downconversion with detection implemented in FPGA



SSR System Block Diagram

Future Plans

- As FPGA become more cost effective and operate at higher speeds, one can include beam steering as well as other processing
- As advances in CMOS progress, higher power amplification might provide both the power and processing speed to reside on a single piece of silicon, thereby reducing the cost of active arrays
- With the advent of higher speed devices, higher frequency direct down conversion will be possible there by reducing cost